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54 **ASBESTOS DECOMPOSITION.**

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EP 0 348 502 B1

Description

The present invention relates generally to the field of processing and decomposition of hazardous materials. Specifically, the present invention provides an effective method for decomposing and disposing asbestos.

Asbestos contamination in buildings around the world is a serious health problem which has been the subject of intense controversy in recent years. Once considered the "miracle mineral" in the insulation industry, asbestos has been positively linked to respiratory diseases. Examples of asbestos-related diseases include asbestosis, lung cancer, and mesothelioma. A survey by the U.S. Environmental Protection Agency (E.P.A.) estimates that asbestos in various forms has been used in insulation in more than 30,000 public schools and 730,000 public or commercial buildings.

A general industry to abate or remove offending asbestos has been developed in the United States to address the problems discussed above. In addition, a regulation for asbestos issued by the Department of Labor's Occupational Safety and Health Administration for asbestos requires very special handling and ultimate disposal of the waste products produced by the asbestos abatement industry. The process provided by the present invention is intended to provide an effective method for decomposing and effectively disposing of asbestos-related compounds.

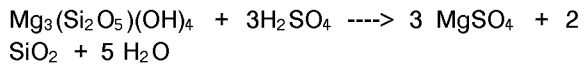
The present invention is comprised by the features in claim 1. Preferred embodiments are subject of the subclaims.

In accordance with the present invention, there is provided an improved method and process for the decomposition and disposal of asbestos compounds. The process of the present invention is broadly comprised of two steps. The first step is decomposition of the asbestos and the second step is the solidification of the products resulting from the first step so that the final product is nonhazardous.

The specific process of the present invention decomposes and fixes or solidifies waste asbestos with a series of novel chemical reactions involving sulfuric acid, a lubricating agent, an accelerating agent, and a cementitious or pozzolanic substance, e.g., Portland cement, ground blast-furnace slag, cement-kiln dust, fly ash or microsilicate, or a mixture of cementitious and pozzolanic materials. The process of the present invention is extremely efficient and can decompose asbestos into rejuvenated silica which can be reclaimed and used as a constituent in numerous subsequent applications. Using the decomposition process of the present invention, therefore, the asbestos is decomposed and forms a solidified mixture which can be easily

handled and safely disposed of at a disposal site.

The process of the present invention comprises two steps. The first step involves the decomposition of asbestos and the other is the solidification of the products of decomposition. Sulfuric acid is used to decompose asbestos. The acid may be new or waste sulfuric acid. With Chrysotile asbestos, typically the following chemical reaction will occur when the pH value of the acid is less than 2:



Excess acid is used to complete the reaction. Silicate (sand) and Magnesium sulfate are formed through this reaction. Often, the decomposition step (step 1) requires two stages. In the first stage, concentrated sulfuric acid is used to effect, through dehydration or oxidation and partial hydrolysis, the following: a) detachment of asbestos from the solid object to which it is attached; b) disintegration, and partial decomposition and dissolution of the container of asbestos; c) disintegration, and partial decomposition and dissolution of the components other than asbestos; and d) loosening, breakage and partial decomposition of the asbestos structure. In the preferred embodiment of the present invention, the sulfuric acid used in the above-described first stage has a concentration ranging between 70 percent weight and 98 percent weight, with the preferable concentration being approximately 90 percent weight.

In the second stage, relatively dilute spent or fresh sulfuric acid at a lower concentration is used to totally decompose and dissolve soluble decomposition products through hydrolysis. In the preferred embodiment of the present invention, the sulfuric acid used in the second stage has a concentration of less than 50 percent weight, with the preferable concentration being approximately 30 percent weight. At the end of the decomposition step, the mixture must have a pH value below 2 and preferably below 1 to ensure the essentially complete decomposition of the asbestos.

Before solidifying the resultant mixture with pozzolanic materials, lime or hydrated lime is added to increase the pH value of the mixture to near 7. During the neutralization, calcium sulfate is formed. A mixture of calcium and magnesium sulfates is cementitious. Other asbestos are decomposed through similar reactions.

After neutralization, the lubricating agent and accelerating agent is added to the mixture. This is followed by addition of a pozzolanic material to accomplish solidification. The interparticle lubricant used in the present invention accelerates the homogenization of the mixture while solidifying the

waste. The accelerating agent is used to accelerate the rates of cementation processes. In the preferred embodiment of the process of the present invention, the lubricating agent is formed by dispersing water-soluble polymer (e.g., polyethylene glycol-2000) or monomer (e.g., propylene glycol and glycerine) or a mixture of them into the water. The viscosity of the mixture is increased and consequently the diffusivity of every component participating in cementation processes is reduced, thereby decelerating the rates of these processes. The accelerating agent contains ferric chloride, or a similar substance, e.g., calcium chloride, magnesium chloride, or a mixture of these substances. While the rates of cementation processes occurring through the mixture are retarded by the lubricating agent at the outset of the reaction, these rates will gradually be enhanced. Although the chemical reactivity of these compounds are initially inhibited by the lubricating agent, the accelerating agent will eventually participate in accelerating the rates of the cementation processes.

The decomposition and solidification process provided by the present invention offers numerous advantages, including the following: 1) co-disposal with waste acid, e.g., pickling acid, possible; 2) decomposition of asbestos (detoxification) accomplished; 3) significant volume reduction attained; 4) high degree of safety is maintained - no generation of hazardous or toxic by-product such as gaseous HCl, gaseous HF, Cl₂ and F₂ when other acids are used; room temperature and atmosphere operation.

The operation of the process provided by the present invention can be understood by the following summary of steps and examples:

FIRST EXAMPLE OF ASBESTOS DECOMPOSITION

Substep 1. Add 160.00 grams of 36% sulfuric acid

Substep 2. Add 40.00 grams of Chrysotile asbestos

Substep 3. Add 20.00 grams of water

Substep 4. Add 20.00 grams of calcium hydroxide

Substep 5. Add 6.00 grams of accelerating agent

Substep 6. Add 14.00 grams of lubricating agent

Substep 7. Add 180.00 grams of pozzolanic materials

The ratios of the chemicals and the substeps used in the first example described above is especially efficient for decomposing and disposing of asbestos containing relatively small amounts of foreign matter. The time required for decomposition is extremely short -- on the order of ten to twenty minutes depending on the mode of operation and

the concentration of the acid used. Variations in the concentration of the acid can be made without departing from, the scope of the present invention. Furthermore, pure acids, diluted or waste acids can be used. The additional water used in substep 3 is used to render the mixture homogeneous.

SECOND EXAMPLE OF ASBESTOS DECOMPOSITION

Substep 1. Add 10.00 grams of 96% sulfuric acid in a beaker

Substep 2. Add 140.00 grams of waste

Substep 3. Add 66.70 grams of 30% sulfuric acid

Substep 4. Add 33.30 grams of water

Substep 5. Add 15.00 grams of calcium hydroxide

Substep 6. Add 10.00 grams of accelerating agent

Substep 7. Add 15.00 grams of lubricating agent

Substep 8. Add 80.00 grams of pozzolanic materials

The ratios of chemicals and the substeps described in the second example described above is especially efficient for decomposing and disposing of asbestos containing relatively large amounts of foreign matter. The time required for decomposition is extremely short -- on the order of one to five minutes depending on the mode of operation and the concentration and amount of the acid used. As was the case for the first example, variations in the concentration of the acid can be made without departing from the scope of the present invention. Again, pure acids, diluted or waste acids can be used. The additional water used in substep 4 is used to render the mixture homogeneous.

Claims

1. A method for decomposing asbestos containing foreign matter comprising the steps of:
 - reacting a quantity of material containing asbestos with sulfuric acid to produce a first mixture, said first mixture containing reaction products comprising completely decomposed particles of said asbestos, said first mixture having a pH value of less than 2;
 - reacting said first mixture with a neutralizing agent to produce a second mixture, said second mixture having a pH value of approximately 7; and
 - reacting said second mixture with a lubricating agent, an accelerating agent, and a cementitious or pozzolanic substance to produce a third mixture, said third mixture comprising a solidified compound containing said decomposed particles of said asbestos, said solidified

mixture providing effective containment of said asbestos particles.

2. The method according to claim 1, said step of reacting said material containing asbestos to produce a first mixture comprising a first stage of reacting said material with a quantity of sulfuric acid having a concentration of between 70 and 98 percent per weight to produce a mixture containing partially decomposed asbestos particles, and comprising a second stage of reacting the mixture obtained in the first stage with a second quantity of sulfuric acid having a concentration of less than 50 percent per weight to produce said first mixture. 5 10 15
3. The method according to claim 2, said neutralizing agent being selected from the group consisting of alkaline materials, preferably of lime, hydrated lime or calcium hydroxide. 20
4. The method according to claim 3, said accelerating agent being selected from the group consisting of calcium chloride, ferric chloride, and magnesium chloride. 25
5. The method according to claim 4, said lubricating agent being selected from the group consisting of water-soluble polymers or monomers. 30

Patentansprüche

1. Ein Verfahren zum Zersetzen von Asbest, der Fremdstoffe enthält, mit folgenden Verfahrensschritten: 35
 - Behandeln einer Menge von Asbest enthaltendem Material mit Schwefelsäure zur Gewinnung eines ersten Gemisches, wobei das erste Gemisch Reaktionsprodukte enthält, die vollständig zersetzte Partikel von genanntem Asbest aufweisen, und das erste Gemisch einen pH-Wert von weniger als 2 aufweist; 40
 - Behandeln des ersten Gemisches mit einem Neutralisierungsmittel zur Gewinnung eines zweiten Gemisches, wobei das zweite Gemisch einen pH-Wert von näherungsweise 7 hat; und 45
 - Behandeln des zweiten Gemisches mit einem Gleitmittel, einem Beschleuniger und einer zementartigen oder puzzolanischen Substanz zur Gewinnung eines dritten Gemisches, wobei das dritte Gemisch eine verfestigte Verbindung aufweist, die die zersetzten Asbestpartikel enthält, wobei das verfestigte Gemisch ein effektives Containment für die Asbestartikel bildet. 50 55

2. Das Verfahren entsprechend Anspruch 1, wobei der Schritt des Behandelns des Asbest enthaltenden Materials zur Gewinnung eines ersten Gemisches eine erste Verfahrensstufe, in der das Material mit einer Menge von Schwefelsäure, die eine Konzentration von 70 bis 98 Gew.-% aufweist, reagiert, um ein Gemisch zu gewinnen, das teilweise zersetzte Asbestpartikel enthält, und eine zweite Verfahrensstufe aufweist, bei der das in der ersten Stufe gewonnene Gemisch mit einer zweiten Menge von Schwefelsäure, die eine Konzentration von weniger als 50 Gew.-% aufweist, reagiert, um das erste Gemisch zu erzeugen.
3. Das Verfahren entsprechend Anspruch 2, wobei das genannte Neutralisierungsmittel aus der Gruppe ausgewählt wird, die aus alkalischen Materialien bestehen, bevorzugt aus Kalk, Löschkalk oder Kalziumhydroxid.
4. Das Verfahren entsprechend Anspruch 3, wobei der Beschleuniger aus der Gruppe ausgewählt wird, die aus Kalziumchlorid, Eisenchlorid und Magnesiumchlorid besteht.
5. Das Verfahren entsprechend Anspruch 4, wobei das genannte Gleitmittel aus der Gruppe ausgewählt wird, die aus wasserlöslichen Polymeren oder Monomeren besteht.

Revendications

1. Procédé pour décomposer de l'amiante contenant de la matière étrangère comprenant les étapes consistant à :
 - faire réagir une certaine quantité de matériau contenant l'amiante avec de l'acide sulfurique pour produire un premier mélange, ledit premier mélange contenant des produits de réaction comprenant des particules complètement décomposées de ladite amiante, ledit premier mélange ayant un pH inférieur à 2;
 - faire réagir ledit premier mélange avec un agent neutralisant pour produire un deuxième mélange, ledit deuxième mélange ayant un pH d'environ 7; et
 - faire réagir ledit deuxième mélange avec un agent de lubrification, un accélérateur, et une substance cimenteuse ou pouzzolanique pour produire un troisième mélange, ledit troisième mélange comprenant un composé solidifié contenant lesdites particules décomposées de ladite amiante, ledit mélange solidifié constituant un conditionnement efficace desdites particules d'amiante.

2. Procédé selon la revendication 1, ladite étape consistant à faire réagir ledit matériau contenant l'amiante pour produire un premier mélange comprenant une première phase consistant à faire réagir ledit matériau avec une quantité d'acide sulfurique ayant une concentration comprise entre 70 et 98 pour-cent en poids pour produire un mélange contenant des particules d'amiante partiellement décomposées, et comprenant une seconde phase consistant à faire réagir le mélange obtenu dans la première phase avec une deuxième quantité d'acide sulfurique ayant une concentration de moins de 50 pour-cent en poids pour produire ledit premier mélange.
3. Procédé selon la revendication 2, ledit agent neutralisant étant choisi dans le groupe composé de matériaux alcalins, de préférence de la chaux, de la chaux hydratée ou de l'hydroxyde calcium.
4. Procédé selon la revendication 3, ledit accélérateur étant choisi dans le groupe composé du chlorure calcium, du chlorure ferrique, et du chlorure de magnésium.
5. Procédé selon la revendication 4, ledit agent lubrifiant étant choisi dans le groupe composé de polymères ou monomères solubles dans l'eau.

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